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An annotated checklist of the Noctuoidea of Jordan with remarks on ecology, phenology and zoogeography. Part I: Erebidæ & Euteliidæ (Lepidoptera: Noctuidæ)

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T. Witt & G. C. Müller

Abstract

A complete list of the presently known 94 Erebidæ and 2 Euteliidæ species of Jordan is presented, and the biogeography, phenology and distribution of the same are discussed. Within a German - Israeli project to monitor the Lepidoptera Fauna of the Levant we record from 1986 to 2010 a total of 96 species, 26 of which (27.1%) are new records for the country. In Jordan the Erebidæ are represented by 7 subfamilies and 37 genera, the 2 Euteliidæ are within the same genus. Most of the recorded species belong to the Catocalinæ (63) and Eublemminæ (22), the majority of the species are of an Eremic (43), Mediterranean (23) and Irano-Turanian (16) distribution pattern. Most of the Erebidæ (55) are clearly concentrated within one vegetation zone, while the 16 species of tropical origin (ubiquitous, polyphagous) are distributed often all over the country. In Jordan almost all the Eremic and Irano-Turanian species known from the Levant are found, whereas the Mediterranean, Tropical and Palearctic elements of the same region are represented only by about half, or even less of the known species. Forty species are uni-voltine with the highest rate of occurrence in spring from March to April; the other species are multi-voltine, flying at least twice - in spring and again later in autumn - from October to November. During the summer practically only multi-voltine species are found.

KEY WORDS: Lepidoptera, Noctuidæ, Erebidæ, Euteliidæ, ecology, phenology, zoogeography, Jordan.

Una lista comentada de los Noctuoidea de Jordania con detalles sobre ecología, fenología y zoogeografía.

**Parte I: Erebidæ & Euteliidæ
(Lepidoptera: Noctuidæ)**

Resumen

Se presenta una lista de las especies actualmente conocidas de Jordania 94 Erebidæ y 2 Euteliidæ, y se discute su biogeografía, fenología y distribución. Dentro de un proyecto germano-israelí para censar las fauna de Lepidoptera del Próximo Oriente registramos desde 1986 hasta 2010 un total de 96 especies, de las cuales 26 (27.1 %) son nuevos registros para el país. En Jordania los Erebidæ están representados por 7 subfamilias y 37 géneros, y todos los 2 Euteliidæ están dentro del mismo género. La mayoría de las especies registradas pertenecen a los Catocalinæ (63) y Eublemminæ (22), la mayoría de las especies presentan patrones de distribución erémica (43), mediterránea (23) e irano-turánica (16). La mayor parte de los Erebidæ (55) están claramente concentradas dentro de una zona de vegetación, mientras que las 16 especies del origen tropical (ubícuas, polífagas) están, a menudo, distribuidas por todo el país. En Jordania se han censado casi todas las especies erémicas e irano-turánicas encontradas en el Próximo Oriente, mientras que los elementos mediterráneos, tropicales y paleárticos de la misma región están representados solamente por aproximadamente la mitad, o incluso menos de las especies conocidas. Cuarenta especies son univoltinas con la tasa más alta de ocurrencia en primavera (marzo a abril); las otras especies

son multivoltinas, votando por lo menos dos veces por año - en primavera y otra vez después en el otoño, de octubre a noviembre. Durante el verano prácticamente todas las especies encontradas son multivoltinas.

PALABRAS CLAVE: Lepidoptera, Noctuidae, Erebidae, Euteliidae, ecología, fenología, zoogeografía, Jordania.

Introduction

The family Erebidae is part of the superfamily Noctuoidea and has been proposed to include the Calpinae, Catocalinae, Herminiinae, Hypeninae from the former family Noctuidae (GOATER *et al.*, 2003; FIBIGER & LAFONTAINE, 2005). Some authors also regard the Lymantriinae and Arctiinae as part of the Erebidae. The last two families are excluded from the present study and will be published later as part of the “Bombyces and Sphinges” of Jordan. The Euteliidae, formerly classified as a subfamily of Noctuidae, have been raised quite recently to an independent family (ZAHIRI *et al.*, 2010; 2011). In past studies they were included in the Erebidae (KRAVCHENKO *et al.*, 2007a) and therefore we decided to include this small family in this paper. Faunistic surveys of Jordanian Noctuidae (HACKER & SCHREIER, 2001; HACKER, 2001; HACKER *et al.*, 2001; FABIANO & ZILLI, 2001; STADIE & LEHMANN, 2012; KATBEH-BADER, 2013) have revealed more than 200 species.

In contrast to the more uniform and monotonous morphology of most of the Arabian Peninsula, the territory of Jordan is morphologically rather distinct. The Jordanian territory can be divided into six main regions: the Western Mountain Range and Northern Highlands east of the Rift, the Southern Mountain Desert, the Central Plateau, (including the Al-Jafr and Al-Azraq Wadi as-Sirhan basin), the Northern Basalt Plateau, the North-Eastern Plateau and the Wadi al-Arabah -Jordan Rift Valley (KOSSWIG, 1955).

Jordan is situated in the transitional zone of the Mediterranean climate in the west and the arid and hyper arid climate of the Syrian and Arabian Deserts to the northeast and south (DE LATIN, 1967). Accordingly the climate of Jordan is characterized by rainy winter seasons and pronounced droughts during the summer months. High rainfall zones coincide with the higher mountain ranges and a marked rain shadow is common in the foothills (ASHBEL, 1951). In the Western Mountain Range, temperatures frequently drop below freezing, and during most winters snow is common. The highest rainfall occurs over the major mountain blocks of the Western Highlands with annual mean precipitation ranging from 200 to 600 mm. Precipitation decreases rapidly towards the Jordan Valley, the Dead Sea, and the Wadi Araba to less than 100 mm and 50 mm respectively. In most of the Central Plateau and in the Eastern Desert, where the land slopes gently to the Arabian Desert, the mean annual rainfall drops to less than 50 mm. Precipitation varies from year to year; the range being most pronounced in the Central Plateau and in the southern part of the Western Highlands. Here, extreme records of a few millimeters to more than 200 mm per year, are common (ORNI & EFRAT, 1980; JAFFE, 1988).

The plants of Jordan belong to four major phyto-geographic regions (EIG, 1931-32; ZOHARY, 1962; 1966), (Fig. 1). On the Jordanian side of the Rift Valley, the Mediterranean Zone stretches about 150 km further south than on the western counter part in Israel. Mediterranean vegetation is typical for those areas of the Western Mountain Range and the Northern Highlands, which receive an annual average precipitation of 350 mm or more. Since historical times man has intensively managed this region and nowadays cultivated fields or orchards dominate large areas. The woodland in Jordan has been influenced by different human activities for millennia; today no natural formations are left, maquis (often dominated by oaks), reforested pines, orchards and single trees surviving at the margins of cultivated land show the former woodland boundaries. Usually, forest density decreases from north to south; towards the south and at lower altitude Park Forests with scattered trees and bushes are common, semi-shrubs and their companions often cover abandoned soils.

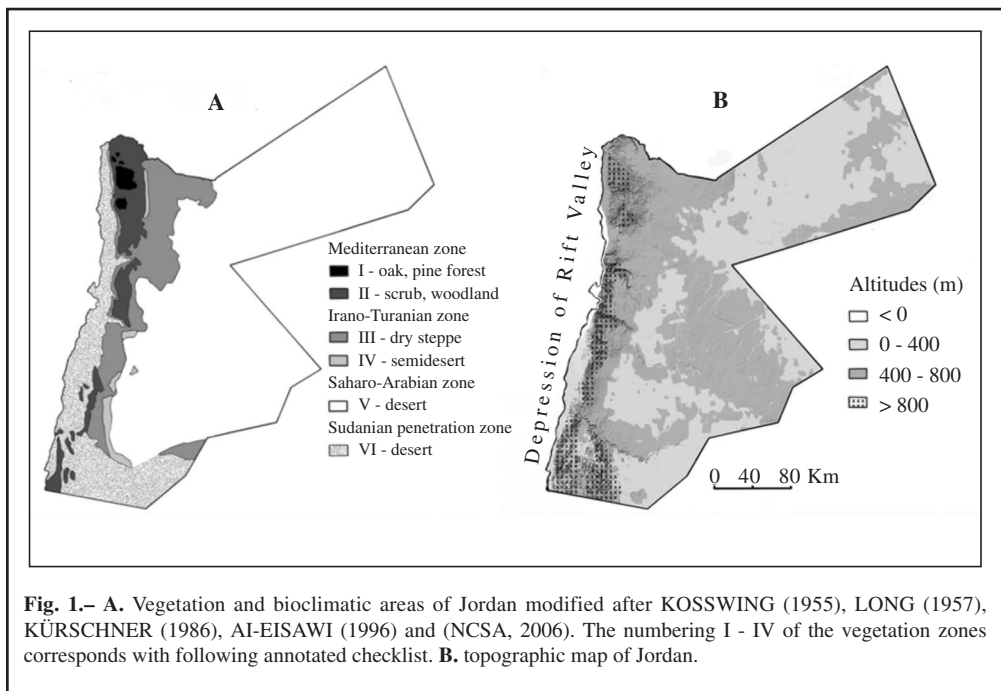
The Irano-Turanian Zone stretches from its southwest border in Jordan through Iran, and Central Asia to the Gobi Desert. It is a semi-arid area with average annual rainfall of 200-300 mm during winter only. In the Levant this zone is often a narrow belt and a transition between the Mediterranean and the nearby desert areas. In areas with high precipitation rich, tall grassland is found but towards the

desert there is a gradual transition to low brush or dwarf bush communities, dominated by *Artemisia* plant associations. The drier part of this transition zone is often also called “semi-desert”.

In the Saharo-Arabian Zone, “true desert”, centered on the Arabian Peninsula, vegetation prevails often with much less than 200 mm of annual rainfall. Depending on soil and availability of water dozens of plant communities can be found even here. In the driest parts of the desert, the vegetation is concentrated in wadis, on rocky slopes and other water catchments while other areas may be totally bare of any vegetation.

The Sudanian Penetration Zone is situated in the Wadi al-Arabah-Jordan Rift and to a lesser extent in some oases towards the east. These distinct oases are created by small streamlets from the hills or by high underground water tables (ZOHARY & ORSHANSKY, 1949). Some of the oases are situated in or near swampy marshes. Nevertheless the dominant elements are several species of thermophile Sudanian trees and date palms. The oases are often surrounded by halophytic vegetation and finally extreme desert. These Ethiopian-Sudanian pockets are relics from climate fluctuations during the Quaternary period (SHMIDA & ARONSON, 1986). In Jordan as well as in Israel these habitats along the Rift Valley are rapidly destroyed by intense agriculture.

Owing to its geographical position, the topography and the pronounced climate, Jordan is like Israel a meeting point for fauna and flora from as widely distant origins as Western Europe, Inner Asia and North and East Africa. Many species find here their furthest point of distribution (FURTH, 1975).



Material and methods

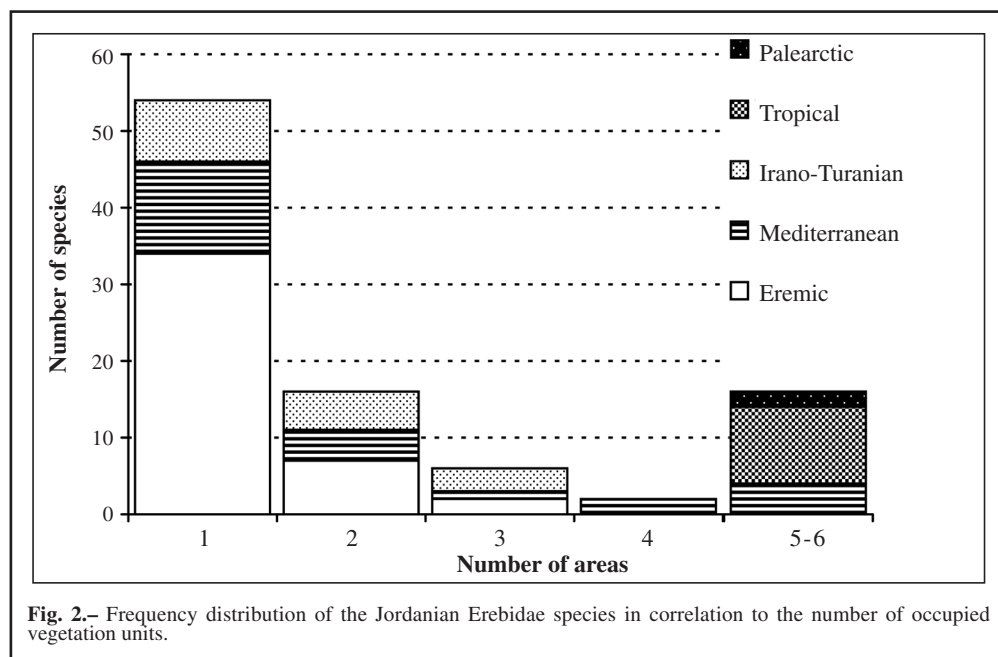
Intensive collections in the field were conducted from 1998-2010 as a part of the German-Israeli project for the study of the Middle Eastern Lepidoptera fauna. This project was a joint effort of the Hebrew University and Tel Aviv University in Israel and the Zoologische Staatssammlungen und Museum Witt, München in Germany (MÜLLER *et al.*, 2006)

Lepidoptera were collected over a period of 12 years totalling about 500 nights of mobile light traps powered by generator (250 Watt bulbs HQL & ML) and about 1000 nights of mobile light trap systems powered by batteries (12Volt 8 Watt and 20Watt, 6 Volt 4 Watt Black light UVB tubes) moved on a daily basis. Additionally several permanent light traps (220V 20W Black light UVB & UVC tubes) were maintained over several years. These traps were relocated on an annual basis; from year to year 4 to 6 such traps were operated.

Results and discussion

In Jordan presently 94 species of Erebidae and 2 species of Euteliidae are known. About one quarter of these species (26/96) are for the first time recorded for this country but at the same time none of these species is new to the Levant. The recorded species represent 7 subfamilies and 37 genera; most of the species belong to the Catocalinae (62) and Eublemminae (22). The majority of species are Eremic (43), Mediterranean (24) and Irano-Turanian (17), while Tropical and Palearctic elements are only represented with a total of 12 species.

Most Jordanian Erebidae (55) inhabit only one vegetation unit (Fig. 1- 2). All 8 species of the genus *Anumeta* belong within this group. The genus *Anumeta* is typically found at the bottom of the Rift Valley and the early stages develop on *Calligonum* (Polygonaceae). This is also the principal distribution area of the genus *Clytie* (7 species) that is also monophagous, but on *Tamarix* (Tamaricaceae). Other species like *Tytroca dispar*, *Scodionyx mysticus*, *Heteropalpia acrosticta*, are dependent on the numerous *Acacia* (Fabaceae) stands. The rest of this group are Irano-Turanian and Mediterranean elements like species of genera *Catocala* and *Minucia* which are likewise monophagous but on broad leaved trees. The number of eurytopic species (like many pests), principally occurring in 2, 3 and 4 vegetation units is considerably lower. The group of species occurring in 5 or all vegetation units (i.e. occurring all over the country) consists of 16 ubiquitous and polyphagous species mainly of tropical origin. Typical examples are some species of genus *Eublemma*, *Pandesma robusta* and *Tathorhynchus exsiccata*.



The 96 species presented in this paper compose about two thirds (96 / 135) of the total known Erebiidae and Euteliidae fauna of the Levant; regarding Eremic and Irano-Turanian elements the differences are even smaller with 84% and 75% respectively (Fig. 3). In contrast Mediterranean species are represented in Jordan only by 51% and Palearctic species only by 35%. This difference can easily be explained by the lack of high mountains and corresponding oro-Mediterranean and montane-steppe habitats typical for the northwestern Levant. The desert habitats of the southern Levant are in contrast very well represented in Jordan.

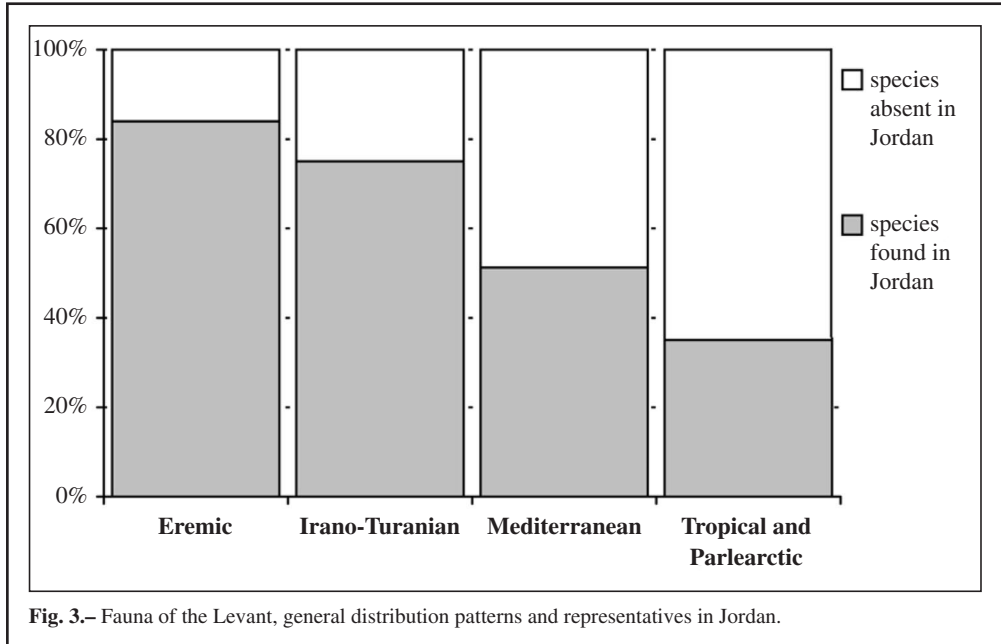


Fig. 3.– Fauna of the Levant, general distribution patterns and representatives in Jordan.

Apart from specific habitat preferences most Erebiidae also display distinct seasonal flight patterns (Table 2). Forty species are uni-voltine (developing in one generation per year), flying only once a year, with the highest rate of occurrence in March / April, while uni-voltine autumn species are absent. The other species are multi-voltine, flying at least twice a year, predominantly in March/April, and again in October / November.

Table 2.– Phenology of the Jordanian Erebiidae.

Month	Univoltine	Multivoltine
Jan		
Feb	1	
Mar	12	11
Apr	11	28
May	10	13
Jun	4	2
Jul	1	
Aug	1	
Sep		2
Oct		16
Nov		28
Dec		8

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Table 1.— List of Erebidae species and their distribution in main vegetation areas. * - new records for Jordan. Main vegetation areas: Oak - oak / pine forest, Scrub - scrub / woodland, Step - dry steppe, Semi - semidesert, Des - desert Saharo-Arabian, Sud - desert Sudanian. Penetration. X - presence of species

SPECIES	Oak	Scrub	Step	Semi	Des	Sud
CALPINAЕ						
CALPINI						
1. <i>Africalpe intrusa</i> Krüger, 1939						X
CATOCALINAЕ						
ACANTOLIPINI						
2. <i>Acantholipes regularis</i> (Hübner, [1813])*			X			
ANYDROPHILINI						
3. <i>Anydrophila stuebeli</i> (Calberla, 1891)						X
AUDEINI						
4. <i>Ulotrichopus tinctipennis</i> (Hampson, 1902)*						X
CATOCALINI						
5. <i>Catocala conjuncta</i> (Esper, 1787)*	X					
6. <i>Catocala conversa</i> (Esper, 1787)*	X					
7. <i>Catocala editarevayae</i> Müller, Kravchenko, Speidel, Witt, Junnila, Mooser, Saldaitis & Reshöft, 2008						X
8. <i>Catocala elocata</i> (Esper, 1787)	X					
9. <i>Catocala eutychea</i> (Treitschke, 1835)*	X	X				
10. <i>Catocala nymphagoga</i> (Esper, 1787)	X	X				
11. <i>Catocala olgaorlova</i> Kravchenko, <i>et al.</i> , 2007			X			
12. <i>Catocala puerpera syriaca</i> Schultz, 1909					X	
MELIPOTINI						
13. <i>Drasteria flexuosa</i> (Ménétrières, 1847)			X	X	X	X
14. <i>Drasteria herzi</i> (Alphéraky, 1895)				X	X	X
15. <i>Drasteria kabylaria</i> (A. Bang-Haas, 1906)				X	X	X
16. <i>Drasteria oranensis arabica</i> Wiltshire, 1990*						X
OPHIUSINI						
17. <i>Catephia alchymista</i> ([Denis & Schiffermüller], 1775)*	X					
18. <i>Cerocala sana</i> Staudinger, 1901				X	X	X
19. <i>Clytie arenosa nabataea</i> Hampson, 1913						X
20. <i>Clytie delunaris</i> (Staudinger, 1889)*						X
21. <i>Clytie infrequens moses</i> (Staudinger, 1895)			X	X	X	X
22. <i>Clytie sancta</i> (Staudinger, 1898)				X	X	X
23. <i>Clytie scotorrhiza</i> Hampson, 1913*						X
24. <i>Clytie syriaca</i> (Bugnion, 1837)*				X	X	X
25. <i>Clytie terrulenta gentilis</i> (Staudinger, 1898)	X					
26. <i>Dysgonia algira</i> (Linnaeus, 1767)	X	X				
27. <i>Dysgonia rogenhoferi</i> (Bohatsch, 1880)*	X					
28. <i>Dysgonia torrida</i> (Guenée, 1852)	X	X				
29. <i>Gnamptonyx innexa</i> (Walker, 1858)*					X	X
30. <i>Grammodes bifasciata</i> (Petagna, 1788)*						X
31. <i>Grammodes boisdeffrii</i> (Oberthür, 1867)						X
32. <i>Grammodes stolidia</i> (Fabricius, 1775)*					X	X
33. <i>Heteropalpia acrosticta</i> (Püngeler, 1904)						X

34. <i>Heteropalpia profesta sacra</i> (Staudinger, 1898)						X
35. <i>Minucia lunaris</i> ([Denis & Schiffermüller], 1775)	X					
36. <i>Minucia wiskotti</i> (Püngeler, 1902)		X				
37. <i>Ophiusa tirhaca</i> (Cramer, 1777)	X	X	X			
38. <i>Pandesma robusta</i> (Walker, 1858)	X	X	X	X	X	X
39. <i>Pericyma albidentaria</i> (Freyer, 1842)*					X	X
40. <i>Pericyma squalens</i> Lederer, 1855			X	X	X	X
41. <i>Rhabdophera arefacta</i> (Swinhoe, 1884)					X	X
42. <i>Tytroca dispar</i> (Püngeler, 1904)					X	X
43. <i>Zethes insularis</i> Rambur, 1833	X	X				
SCODIONYCHINI						
44. <i>Scodionyx mysticus</i> Staudinger, 1900						X
TOXOCAMPINI						
45. <i>Anumeta arabiae</i> Wiltshire, 1961						X
46. <i>Anumeta asiatica</i> Wiltshire, 1961*						X
47. <i>Anumeta atrosignata</i> (Walker, 1858)*						X
48. <i>Anumeta cestis</i> (Ménétrières, 1849)						X
49. <i>Anumeta henkei</i> (Staudinger, 1877)*						X
50. <i>Anumeta hilgerti</i> Rothschild, 1909*						X
51. <i>Anumeta spilota</i> Ershov, 1874*						X
52. <i>Anumeta straminea</i> (A. Bang-Haas, 1906)*						X
53. <i>Apopestes spectrum</i> (Esper, 1787)		X	X			
54. <i>Autophila anaphanes</i> Boursin, 1940*	X	X				
55. <i>Autophila cerealis</i> (Staudinger, 1871)	X	X	X	X	X	X
56. <i>Autophila cymaenotaenia orthotaenia</i> Wiltshire, 1944			X			
57. <i>Autophila luxuriosa</i> Zerny, 1933			X	X		
58. <i>Autophila pauli</i> Boursin, 1940			X	X	X	X
59. <i>Autophila limbata</i> (Staudinger, 1871)				X		
60. <i>Exophyla rectangularis</i> (Geyer, 1828)	X					
61. <i>Lygephila cracca</i> ([Denis & Schiffermüller], 1775)*	X					
62. <i>Tathorhynchus exsiccata</i> (Lederer, 1855)	X	X	X	X	X	X
EUBLEMMINAE						
63. <i>Eublemma albina</i> (Staudinger, 1898)						X
64. <i>Eublemma albivestalis</i> Hampson, 1910						X
65. <i>Eublemma apicipunctalis</i> (Brandt, 1939)*					X	X
66. <i>Eublemma cochylioides</i> (Guenée, 1852)	X	X	X	X	X	X
67. <i>Eublemma cynerea</i> (Turati, 1924)				X	X	X
68. <i>Eublemma deserti</i> Rothschild, 1909*						X
69. <i>Eublemma gayneri</i> (Rothschild, 1901)						X
70. <i>Eublemma gratissima</i> (Staudinger, 1892)		X	X			
71. <i>Eublemma kruegeri</i> (Wiltshire, 1970)						X
72. <i>Eublemma ostrina</i> (Hübner, [1808])	X	X	X	X	X	X
73. <i>Eublemma hansa</i> (Herrich-Schäffer, 1851)	X					
74. <i>Eublemma chlorotica</i> (Lederer, 1858)	X					
75. <i>Eublemma pallidula</i> (Herrich-Schäffer, 1856)						X
76. <i>Eublemma suppura</i> (Staudinger, 1892)	X					
77. <i>Eublemma parva</i> (Hübner, [1808])	X	X	X	X	X	X

78. <i>Eublemma polygramma</i> (Duponchel, 1836)	X					
79. <i>Eublemma scitula</i> (Rambur, 1833)	X	X	X	X	X	X
80. <i>Eublemma siticulosa</i> (Lederer, 1858)				X	X	X
81. <i>Metachrostis dardouini</i> (Boisduval, 1840)			X			
82. <i>Metachrostis velocior</i> Staudinger, 1892	X	X	X	X	X	X
83. <i>Metachrostis velox</i> (Hübner, [1813])			X			
84. <i>Rhypagla lacernaria</i> (Hübner, [1813])		X				
EUTELINAE						
85. <i>Eutelia adoratrix</i> (Staudinger, 1892)			X			
86. <i>Eutelia adulatrix</i> (Hübner, [1813])	X	X	X			
HERMINIINAE						
87. <i>Nodaria nodosalis</i> (Herrich-Schäffer, 1851)*	X					
88. <i>Polypogon plumigeralis</i> (Hübner, [1825])*	X					
HYPENINAE						
89. <i>Hypena lividalis</i> (Hübner, 1796)	X	X	X	X	X	X
90. <i>Hypena obsitalis</i> (Hübner, [1813])	X					
91. <i>Zekelita antiqualis</i> (Hübner, [1809])	X	X				
92. <i>Zekelita ravalis</i> (Herrich-Schäffer, 1851)	X	X	X	X	X	X
HYPENODINAE						
93. <i>Schrankia costaestrigalis</i> (Stephens, 1834)	X					
PHYTOMETRINAE						
94. <i>Antarchaea erubescens</i> (A. Bang-Haas, 1910)	X					